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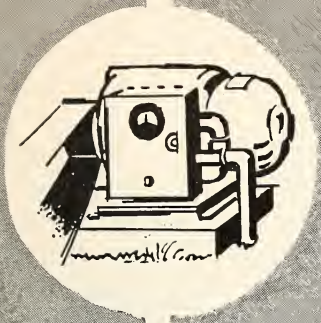
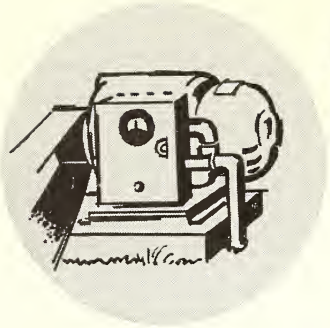


STANDBY ELECTRIC POWER EQUIPMENT

for the farm



STANDBY ELECTRIC POWER EQUIPMENT

for the farm

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Electricity has become essential to farm operation and family living. Milk coolers, water pumps, household furnaces, and other vital equipment require continuous electric-power service.

Storms, accidents, or failure of power equipment at times cause power outages. If an outage lasts for any length of time, serious problems such as food spoilage and loss in production, may arise.

With standby electric-power service, you can keep your electric equipment operating during power outages and avoid the inconvenience and possible financial loss.

EQUIPMENT

Equipment required for standby electric-power service is a generator to produce the alternating current, an engine to run the generator, and a transfer switch for control.

Generator

Kinds of Units

Complete electric plants, consisting of an engine-generator unit and automatic controls, are available. Such units provide automatic standby electric-power service and can substitute for commercial power.

Engine-generator units are also available with manual controls. These units can be of smaller size because some equipment can be turned off or disconnected when standby power service is needed.

Generators without integral engines can be power takeoff- or belt-driven by tractors or stationary engines. Some tractor-driven generators can be mounted on the tractor.

Type

Farm electric service is normally 120/240 volts, three-wire, single-phase. The voltage rating of the standby generator should correspond as near as possible to the electric-service supply voltage.

Generators with voltage ratings of 115/230 or 120/208 can be used if connected and operated correctly. A 120/208-volt generator is actually a three-phase unit for four-wire service. For single-phase use, one 208-volt lead is left idle and two

leads and the neutral are utilized for service. For standby power service, the voltage output is adjusted to 125/216. Single-phase equipment will operate satisfactorily from the generator; however, motors may show some sluggishness in starting and reduced torque.

If your electric service is three-phase power, consult your power supplier as to the type of generator to use.

Direct-current or two-wire, single-phase generators should not be used with three-wire, alternating current service.

Voltage regulation is the change in output voltage from no-load to full-load. The standby generator should have not more than 10-percent variation under these conditions.

Capacity or Size

Generator capacity, or size, refers to the electric-power output. Generators are rated as to power output in terms of kilowatts or watts (1 kilowatt equals 1,000 watts). (*Some generators may also be rated in kilovolt-amperes or volt-amperes. These ratings multiplied by 0.8 give the power output in kilowatts and watts respectively.*)

This kilowatt or watts rating of a generator, which will be the rating given on the nameplate, may or may not, however, be the maximum power output. Some generators have an overload capacity—their power output can exceed the nameplate rating. Overload capacity of generators can be as much as 100 percent. However, it is usually limited to short, intermittent periods.

Overload capacity will be a factor in selecting the size of generator. It is possible to use a smaller unit with adequate overload capacity instead of a larger one with no overload capacity.

Engine or Tractor

The proper size of engine must be used to run the generator. If you plan to use a separate engine or a tractor, it must develop a minimum of 2 horsepower for each kilowatt (1,000 watts) of electric power produced by the generator. See table on page 4.

Transfer Switch

A transfer switch must be used in the standby electric power equipment installation. It transfers the electric service from the power line to the generator.

If a transfer switch is not used, there could be—

- Feedback of generator voltage on power lines, which would endanger the life of anyone working on the lines.
- Damage to the standby unit.
- Unsatisfactory operation of the standby unit.

Automatic switches, which are part of a complete control panel, are used where standby service is automatic. Manually operated switches are used where standby service is nonautomatic.

The switch should be an enclosed, double-pole, double-throw type. Its ampere rating must be equal to the service entrance amperes (60, 100, 200, or 400 amperes).

DETERMINING GENERATOR SIZE

The size of generator needed for standby power service is determined on the basis of the full-load or the part-load system.

Under the full-load system, all electric equipment may be operated at the same time. Under the part-load system, only part of the electric equipment is operated at one time.

Full Load

The full-load system must be used if standby service is automatic. Ask your power supplier or county agricultural agent to help you determine the size of generator needed.

Part Load

The part-load system works as follows: A power outage occurs; all electric equipment is turned off or disconnected; then, equipment is turned on or started, with the load limited to the capacity of the generator. Staggering the starting load of motors—starting them one at a time—will permit the use of a smaller generator. A 3-kilowatt generator is the smallest size recommended.

To determine the size of generator needed—

- Decide what equipment you want to operate during power outages. Consider also equipment that may be bought later.
- Determine the horsepower of the largest motor. Motor nameplates carry the horsepower rating. Refer to the table below for the size of generator required for this motor. That will be the minimum size needed.
- Decide what other equipment (motors) may have to be operated at the same time as this motor.

Wattage and power requirements for various sizes of electric motors (single-phase 230 volts)

Motor horsepower [1]	Wattage requirements (in watts)		Minimum size of generator (in kilowatts) with overload capacity of—				Minimum engine or tractor rating (in horsepower)
	Starting	Running under load	0	25 percent	50 percent	100 percent	
½ (4.9 amperes)	2, 300	575	3	3	3	3	6
¾ (6.9 amperes)	3, 350	835	4	3	3	3	8
1 (8 amperes)	4, 000	1, 000	5	3	3	3	10
1½ (10 amperes)	5, 000	1, 500	5	5	4	3	10
2 (12 amperes)	7, 500	2, 000	7. 5	5 or 6	5	4	15
3 (17 amperes)	11, 000	3, 000	10	7. 5	6	5	20
5 (28 amperes)	15, 000	4, 500	15	12	10	7. 5	30
7½ (40 amperes)	21, 000	7, 000	20	15	12	10	40

[1] Some motors may not be rated in horsepower. They will have an ampere rating on the nameplate. The ampere rating is an indication of the approximate horsepower of the motor. Ampere ratings may differ slightly from those given here.

• Calculate the wattage required to operate all the motors. They will be started one at a time—the largest first. Each successive one will add its starting load to the load already on the generator.

(*a*) Add the *running* watts of motor No. 1 and the *starting* watts of motor No. 2.

(*b*) Add the *running* watts of No. 1, the *running* watts of No. 2, and the *starting* watts of No. 3.

(*c*) Add the *running* watts of Nos. 1, 2, and 3 and the *starting* watts of No. 4.

(*d*) Continue calculating until all motors to be operated at the same time have been considered. You will need a generator with a starting capacity equal to the maximum wattage demand at any point in the calculations.

After all the motors are running, power will be available for other electric equipment, such as lamps and appliances. Total the *running* watts of the motors. Subtract that figure from the continuous-power-output capacity of the generator selected. The difference is the wattage that will be available.

Check your calculations with your county agent, power supplier, or generator dealer. Before buying a generator, rent or borrow one for trial.

INSTALLATION

The standby-electric-power unit must be correctly installed for satisfactory service and personal safety.

Wiring and equipment should be installed in accordance with the National Electrical Code, local ordinances, and the requirements of the power supplier.

Inspection by the power supplier and local electrical inspector is recommended. This may be required in many localities.

Transfer Switch

The transfer switch should be installed in the wiring system between the power supplier's meter and the service entrance (main fuse box).

Generator

These installation instructions apply primarily to permanently located engine-generator units and tractor-driven generators.

Locate the unit in a safe, dry place. It should be within 25 feet of the transfer switch, preferably within sight.

Mount the unit on a reinforced concrete base at least 6 inches thick. Anchor the mounting bolts in the concrete.

If the unit is located inside a building, be sure there will be adequate ventilation. The engine of a 5-kilowatt generator produces almost as much heat as a house furnace.

Exhaust fumes from the engine (or the tractor if it operates inside the building) must be vented to the outside. Flexible tubing can be used for this purpose. The exhaust pipe of the engine (or the tractor) must be at least 6 inches away from combustible material, because it gets hot during operation.

If the unit is located outdoors, provide a shelter to protect it from the weather. The shelter must be

well ventilated and permit ready access to the equipment.

Provide a floor guide for the tractor of a tractor-driven unit. A guide will permit quick positioning of the tractor and insure proper alinement.

Cover all generator openings with ¼-inch galvanized mesh. This will prevent damage by rats and mice.

Accessory Equipment

A pilot lamp (neon type) connected to the power supplier's line between the meter and the transfer switch will aid in determining when normal power has failed and when it has been restored.

Time-delay fuses or circuit breakers on the generator or between it and the transfer switch will protect the generator against overload damage.

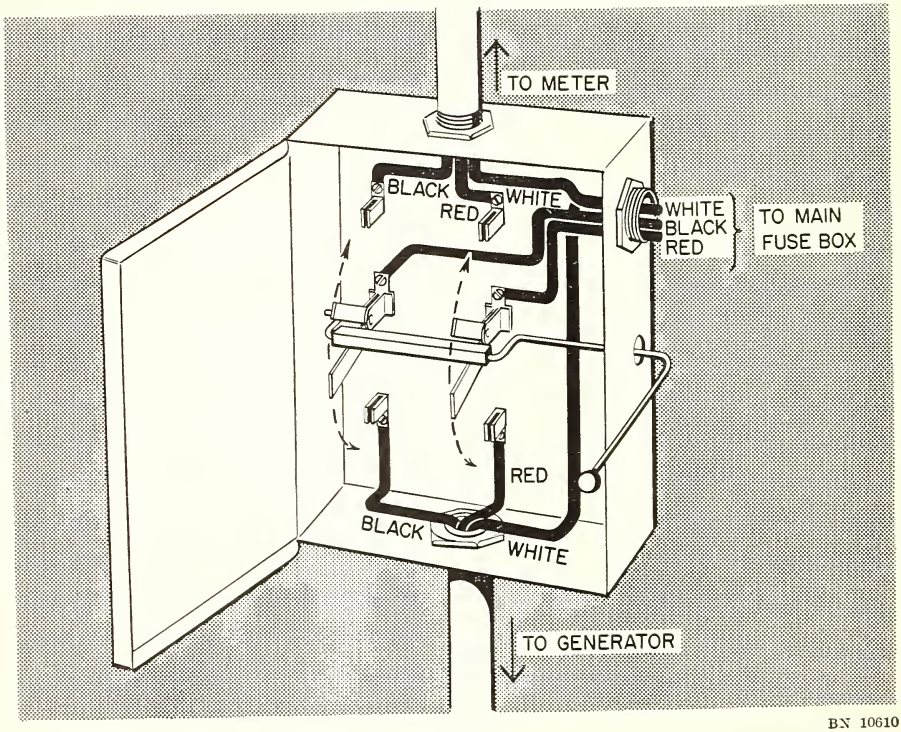
A voltmeter may come with the equipment. If not it can be bought as an accessory.

Frequency meters or tachometers may be used to determine correct generator speed (1,800 or 3,600 r.p.m.).

Tractor tachometers may be used to indicate speed if corrections are made for pulley sizes.

OPERATION

Correct operation of the standby unit is essential for satisfactory service. Study and follow the operating instructions in the manufacturer's manual supplied with the equipment.



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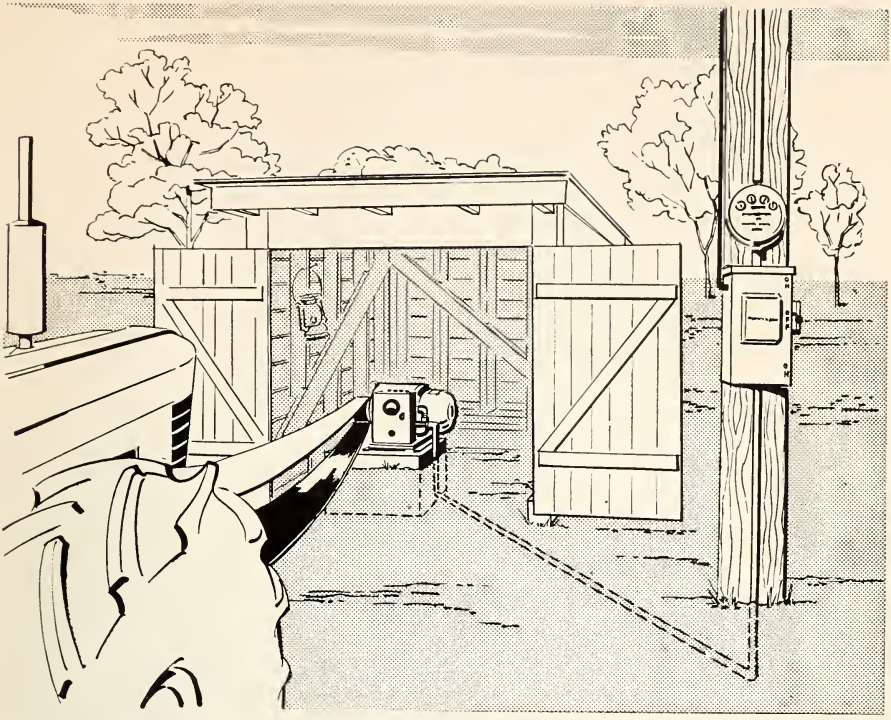
Wiring of a typical transfer switch.



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Installation of a tractor-driven generator and transfer switch.

Run your unit in advance—before an emergency occurs—to make sure it functions properly and to familiarize yourself with the procedure. Make this test run in the daytime and operate on standby power for about 30 minutes.

Automatic Equipment

If your standby unit is automatic, normally no action will be necessary on your part. The unit should start automatically when normal power fails and stop when the power is restored.

Nonautomatic Equipment

If your unit is an engine-generator unit with manually controlled starting or a tractor-driven generator, follow this procedure when a power outage occurs:

- Turn off or disconnect *all* electric equipment.
- Position the tractor or engine. Connect belts or power takeoff drive.
- Start the engine or tractor. Bring the generator up to the proper speed (1,800 or 3,600 r.p.m.). Refer to the manufacturer's instruction book for voltage speed adjustments.
- Check the voltmeter. It should register at least 230 volts for 120/240-volt service, or 115 volts for 120-volt service. When the voltage output is correct, the generator is ready for the load.
- Put the transfer switch in the "generator" position.
- Connect the electrical load. Start the largest motor first. Start

Precautions

Do not use the standby unit if the farm wiring has been damaged or is defective.

If wind, ice, or a farm accident causes the power failure, check the farm wiring before using the standby unit.

Keep flashlights or lanterns handy so that light is available if needed.

Do not keep a large supply of gasoline on hand for exclusive use of the standby unit. Gasoline loses some of its volatile components when stored for long periods, and this may cause difficult starting. The gasoline normally kept for a tractor may be used.

each successive motor when the previous one is running at normal speed. Be careful not to add the load too fast or to overload the generator.

- Check the voltmeter during operation. If voltage falls below 200 for 240-volt service, or 100 for 120-volt service, reduce the load on the generator by turning off some of the electric equipment.

CAUTION.—Increasing generator speed above the normal operating speed of 1,800 or 3,600 r.p.m. will not increase the electric power output.

- When commercial power is restored, turn off all electric equipment. Then stop the standby unit. Put the transfer switch in "normal power" position. Restart or turn on equipment one at a time.

Tractor Operation

A tractor should run at two-thirds to full engine speed (throttle). At speeds less than two-thirds throttle, it may not have enough power and the governor action will be much less exact. For the tractor to run at the proper speed, the generator must be equipped with the correct size pulley.

MAINTENANCE

The standby unit should be kept in good running order at all times so it will be ready for immediate use.

Follow the maintenance instructions in the manufacturer's manual supplied with the equipment.

Test run the unit monthly. Once a year use it for at least an hour. An hour's operation once a month will help keep the engine of an engine-generator unit in good condition.

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